

holds a plurality of tactile pins movably in a vertical direction, the plurality of tactile pins displaying braille graphics; wiring part arranged at a lower end of the unit substrate so that an upper edge of the wiring part is located close to a node portion of each piezoelectric element piece for a bending operation and a lower edge of the wiring part is located close to the fixed end of the piezoelectric element piece, and having an electric circuit in which the fixed ends of the plurality of piezoelectric element pieces are electrically connected to the wiring part.

[0015] A braille graphics cell module according to the second of the present invention is characterized by comprising: a unit substrate; a braille graphics display section which is extended along an upper edge of the unit substrate and holds a plurality of tactile pins movably in a vertical direction, the plurality of tactile pins displaying braille graphics; a plurality of piezoelectric element pieces each having a fixed end and a free end and arranged on a surface of the unit substrate in association with the plurality of tactile pins, the plurality of piezoelectric element pieces being bent; and pushup cams each provided pivotably between the corresponding piezoelectric element piece and tactile pin and each having a first action piece which contacts against the free end of the piezoelectric element and a second action piece having a placement surface on which a lower end of the tactile pin is placed, the pushup cams each being formed to have an obtuse angle between the first action piece and the second action piece, the pushup cams each being pivoted when the first action piece is pushed by the free end of the bent piezoelectric element piece, to push up the tactile pin placed on the second action piece.

[0016] Braille graphics cell modules according to the above aspects may be combined to constitute a braille graphics apparatus.

[0017] Additional objects and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0018] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred embodiments of the invention, and together with the general description given above and the detailed description of the embodiments given below, serve to explain the principles of the invention.

[0019] FIG. 1 is a view schematically showing a configuration of an example of a conventional braille graphics tactile cell;

[0020] FIG. 2 is a view schematically showing a configuration of a braille graphics cell module to which an embodiment of the present invention is applied;

[0021] FIG. 3 is a view schematically showing a configuration of a braille graphics display section of the braille graphics cell module according to the embodiment of the present invention;

[0022] FIG. 4 is a view showing essential parts of the braille graphics cell module according to the embodiment of the present invention;

[0023] FIGS. 5A and 5B are views illustrating a piezoelectric element piece used in the braille graphics cell module according to the embodiment of the present invention; and

[0024] FIG. 6 is a view schematically showing a configuration of a braille graphics tactile apparatus composed of braille graphics cell modules according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] An embodiment of the present invention will be described below with reference to the drawings.

[0026] FIG. 2 schematically shows a configuration of a braille graphics cell module to which the present invention is applied (a front view and a side view).

[0027] FIG. 2 shows an example of a braille graphics cell module provided with 64 braille graphics cells, i.e. 32 braille graphics cells on each side of the cell module. Further, FIG. 2 shows every other piezoelectric element piece for easy-to-see illustration.

[0028] In FIG. 2, a unit substrate 11 is formed of a synthetic resin or the like and shaped like a plate using a molding process. A braille graphics display section 12 is provided along the upper edge of the unit substrate 11 as shown in FIG. 3.

[0029] The braille graphics display section 12 has a block 121 integrated with the unit substrate 11 along its top and a top plate 122 arranged above the block 121 with a predetermined spacing between the top plate 122 and the block 121 (for the details, see FIG. 4).

[0030] The block 121 is formed with 64 hole portions 121a, i.e. two lateral rows each of 32 hole portions 121a. The hole portions 121a in each row are arranged along the opposite surfaces of the unit substrate 11. Further, as shown in FIG. 4, a projecting portion 121b is provided at each end of the block 121. On the other hand, the top plate 122 is formed with 64 hole portions 122a, i.e. two lateral rows each of 32 hole portions 122a in association with the hole portions 121a in the block 121. Further, a bent portion 122b is formed at each end of the top plate 122. A key portion 122c is formed at the tip of the bent portion 122b. By locking the key portion 122c on the projecting portion 121b at each end of the block 121, the top plate 122 is mounted on the block 121.

[0031] Tactile pins 13 are held between the block 121 and the top plate 122 in association with the respective hole portions 121a. As shown in FIG. 4, each of the tactile pins 13 is formed with a flange portion 13b at a position slightly above an intermediate portion of a pin main body 13a. A part of the tactile pin 13 which is located below the flange portion 13b penetrates the corresponding hole portion 121a in the block 121. A part of the tactile pin 13 which is located above the flange portion 13b penetrates the corresponding hole portion 122a in the top plate 122. In this case, the tactile pin 13 has its flange portion 13b always contacted against the block 121 owing to its weight. In this state, the pin main